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The delivery and
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The Delivery and Handling of Miscellaneous Freight at the Boston Freight Terminals

By

HAROLD PENDER, H. F. THOMSON and C. P. ELDRED

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Report of Investigation made by the Electrical Engineering Department
of the Massachusetts Institute of Technology
February, 1914

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The Delivery and Handling of Miscellaneous Freight at the Boston Freight Terminals

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PAPER AND DISCUSSION
AT MEETING OF NEW YORK RAILROAD CLUB
NEW YORK CITY, SEPTEMBER 18

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Object of Study

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Discussion at Meeting of New York Railroad Club

Object of Study

Object of Study. There has been, from time to time, considerable criticism on the part of the shippers and teamsters in Boston of the freight terminal facilities in that city, and of the methods employed by the railroads in sending out notices and in delivering freight, particularly L. C. L. shipments. To determine whether such criticism was justified, the Electrical Engineering Department of the Massachusetts Institute of Technology, in connection with the investigation it was making of the use of motor trucks for freight delivery, had several students in the spring of 1912 make a number of observations on the movements of all kinds of vehicles at the Boston freight terminals. A summary of their observations and conclusions was drawn up and was shown to the Operating Vice-Presidents of the three railroads entering Boston.

Two of the roads were sufficiently interested to contribute to the Institute a sum of $2,000 jointly, to be used to extend this investigation. In the fall of 1912 a Research Assistant was appointed to carry out this investigation, and during the past year he has devoted his entire time to this study, under supervision of the Research Division of the Electrical Engineering Department of the Institute. A discussion of the methods and results of this investigation are given herewith. The discussion naturally falls into two parts, viz., Part I, Analysis of Time Spent by Wagons in the Freight Yards; Part II, Analysis of Time between the Arrival of the Train in the Railroad Yard and the Delivery of Freight. The conclusions derived from the two studies are given at the ends of Part I and Part II respectively.

PART I

ANALYSIS OF TIME SPENT BY WAGONS IN THE FREIGHT YARDS

Description of the Boston Freight Terminals. In Fig. 1 is shown a map of the business district of Boston on which the houses in the freight terminals are indicated by black blocks. In general each of these blocks represents several houses arranged side by side as indicated by the numerals alongside the block. The five blocks in the lower right hand corner represent the 11 freight houses and 2 piers of the N. Y., N. H. & H. Railroad. The two small blocks to the west of the South Station (Boston Terminal) represent the 4 freight houses of the Boston & Albany Railroad. The string of blocks of the upper part of the map to the north and west of the North Station (Union Station) represent the 35 freight houses of the Boston & Maine Railroad.

This last group is divided into three sections handling respectively

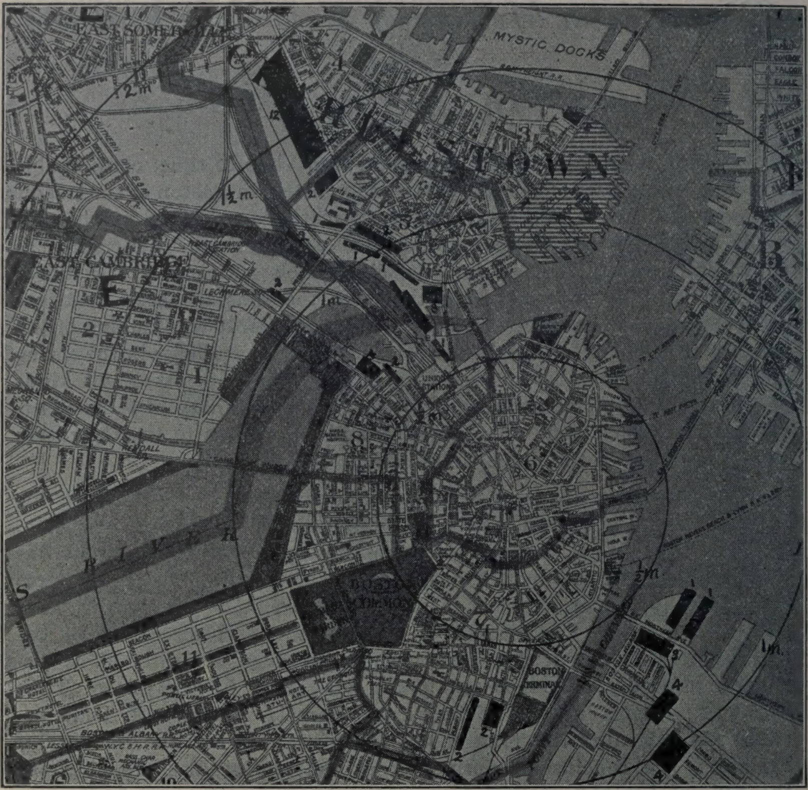

FIG. 1. BUSINESS DISTRICT OF BOSTON

the freight to and from the Southern, the Fitchburg, and the Portland Divisions. In a general way the houses in the vicinity of Minot Street handle the freight for the Southern Division, those in the vicinity of Warren Bridge the freight for the Fitchburg Division, and those in the vicinity of Rutherford Avenue the freight for the Portland Division.

From the map it will be seen that the N. Y., N. H. & H. Terminal, the Boston & Albany Terminal, and the Southern and Fitchburg Divisions of the Boston & Maine Terminal are each within approximately one mile from the center of the business district. The most distant house of the Portland Division is approximately 1¾ miles from the center of the business district. The wholesale district lies chiefly between the Harbor and a line drawn from the North to the South Stations.

In addition to the terminals described above, the freight for reshipment to trans-Atlantic and coast-wise points is handled at the Mystic Docks, the Hoosac Tunnel Docks, the East Boston Docks, and the docks along Atlantic Ave. Our study, however, has been confined to the handling of less-than-car-load freight passing through the houses described in the preceding paragraph.

Methods of Delivering and Receiving Freight. Inward and outward bound shipments are in most instances handled through separate houses. In the New Haven Terminal, 6 of the houses and one-half of each of the 2 piers are used for L. C. L. inward freight and 5 houses for L. C. L. outward freight. In the Boston & Maine Terminal there are 12 houses used for inward, 7 for outward, and 3 for both inward and outward L. C. L. freight. Of the 4 Boston & Albany houses, 2 are used for inward and 2 for outward L. C. L. freight. At the inward freight houses the teamster must himself locate and load his freight. He first receives at the cashier's office a delivery check which designates the house and usually the door at which the freight will be found. After arriving at the door he must enter the freight house, pick out his freight and load it upon his wagon. In case the teamster finds freight in the house for which the delivery check is not available, he may load it upon obtaining a "memorandum" check from the cashier's office.

At the outward houses the teamster must distribute his freight at one or more doors according to its route and destination. He unloads the freight from his wagon at the proper doors and then departs upon obtaining the railroad's receipt of delivery of goods. The N. Y., N. H. & H. Railroad and the Boston & Maine Railroad have issued "Loading Books" which state the house and door at which the freight will be received for any destination. A definite house and door number is given for each destination but the teamsters in general are allowed to unload at any door in the immediate vicinity of the one designated. This tends to avoid congestion and also to make it unnecessary for a teamster to move his wagon from door to door in case he has freight for several points normally unloaded at different doors near one another.

Delivery Checks and Memorandum Checks. The regular delivery check for each consignment is made out in the freight agent's office from the waybill, the latter either coming with the consignment or coming by mail. This delivery check is then sent to the cashier's office at the proper portion of the freight yard and a clerk there puts the proper door number on it as soon as this information is received from the delivery clerk in the freight house. The check is then "racked," i. e., put in a pigeon hole near the window of the cashier's office, where it is available when the teamster calls for it. The method of making out the delivery checks is described more fully in Part II.

The system of memorandum checks referred to above and several times in the following discussion, is used to enable consignees who expect freight to obtain it as soon as it is placed in the freight house, without waiting for the regular delivery check to be completed and "racked." A teamster is permitted to enter the freight house and look for such freight, knowing approximately where it is likely to be located. After finding the freight he may then go to the cashier's office and obtain a check called a "memorandum check," and the freight will be surrendered by the delivery clerk upon presentation of this check. This system, although it requires the driver to spend more time at the freight house, is of considerable advantage to consignees in cases of error on the delivery check or of delay in the arrival of the waybill causing the agent's office delay in making out the delivery check.

Time Spent by Wagons in Freight Yards. It was desired first to find the percentage of the day spent in the freight yards by the average teamster of large trucking concerns handling miscellaneous freight. Observations made for twenty-one days on the one- and two-horse trucks of two of the largest master teamsters in the city showed that these wagons spent approximately one-third of the working day in the freight yards.

Figs. 2 and 3 show graphically the results from these observations. As seen by these plots the teams spent approximately one-third of the working day in the railroad yard. The conditions at the freight terminals, therefore, largely influence the amount of work that can be done by teams doing this class of hauling.

These observations also showed that the delay per day experienced at the warehouses, or stores, was actually greater than the delay due to congestion in the railroad yards. By "delay" as used throughout this paper is meant lost or idle time on the part of the wagon driver. The delay in the case of freight being delivered to the warehouse usually arises from the necessity of waiting for platform space or for the use of an elevator. The delay at the warehouse in the case of freight being loaded is due chiefly to the fact that frequently the goods are not ready for shipment at the time that the teamster calls.

The conclusion that the average delay at the warehouses was greater than the average delay at the railroad yards was substantiated by additional data upon wagons hauling the outputs of two large factories. In one case observations upon more than 700 loads, some of which were delivered to warehouses about the city, and the remainder to the railroads, showed that the unloading time at warehouses was 38 minutes as compared with 29 minutes at railroad yards. These were two-horse

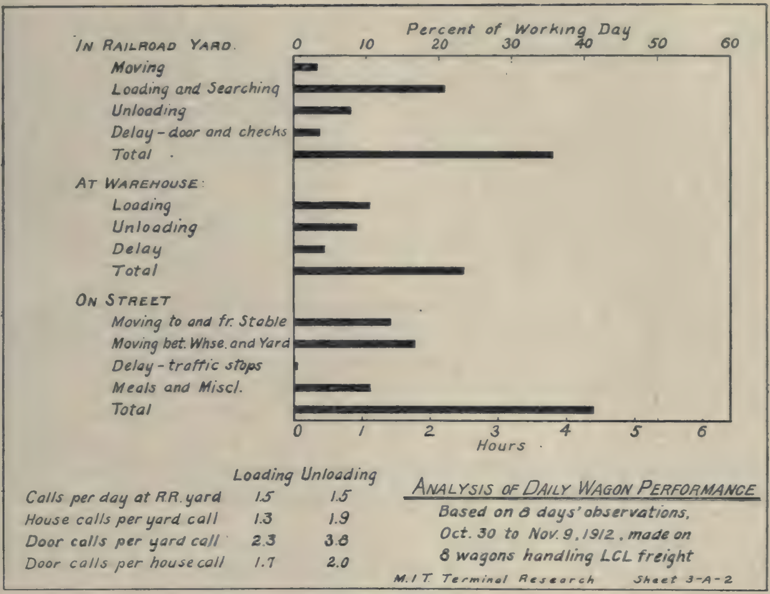

FIG. 2. ANALYSIS OF DAILY WAGON PERFORMANCE

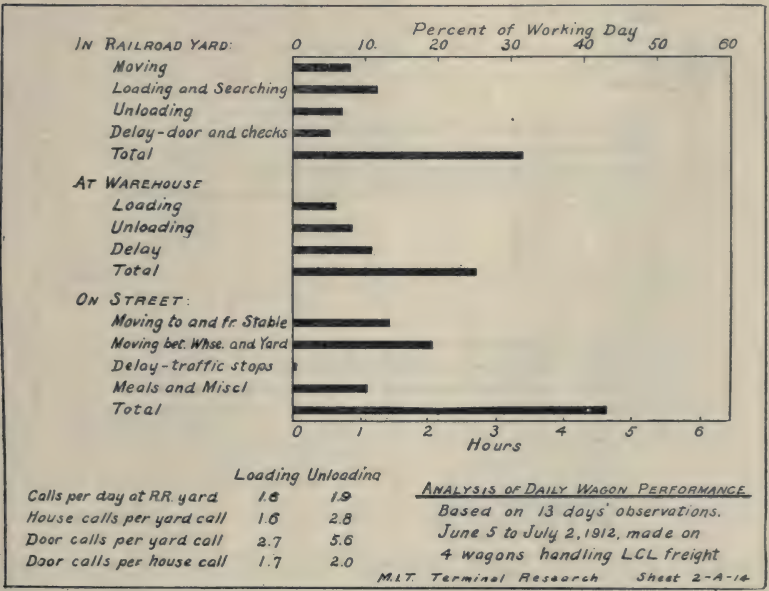

FIG. 3. ANALYSIS OF DAILY WAGON PERFORMANCE

wagons and the loads, composed chiefly of goods packed in barrels, averaged a trifle over four tons each.

In another case observations upon two- and three-horse wagons which took 179 loads away from the factory showed that on the average 51 minutes elapsed between the arrival of the wagon and its departure with load. Of this time only 16 minutes were spent actually loading. The remaining 35 minutes were consumed in waiting for a turn at the loading platform. This delay was due chiefly to poor assignment of the wagons, more wagons being used by the master teamster in doing the trucking than could advantageously operate under the conditions.

Relative Times Spent by Different Classes of Vehicles at the Freight Houses. In connection with our studies of motor trucking, a number of observations were made to determine the relative times spent by different types of vehicles in visiting a given freight house or group of houses. Fig. 4 is a typical plot made up from one set of such observations at two inward houses facing each other. This particular plot gives the division of time from the instant the vehicle entered the roadway between the two houses until it passed out again past the same entrance.

"Load Curves" of Freight Yards. The number of vehicles calling at the Outward and Inward freight houses throughout typical days was

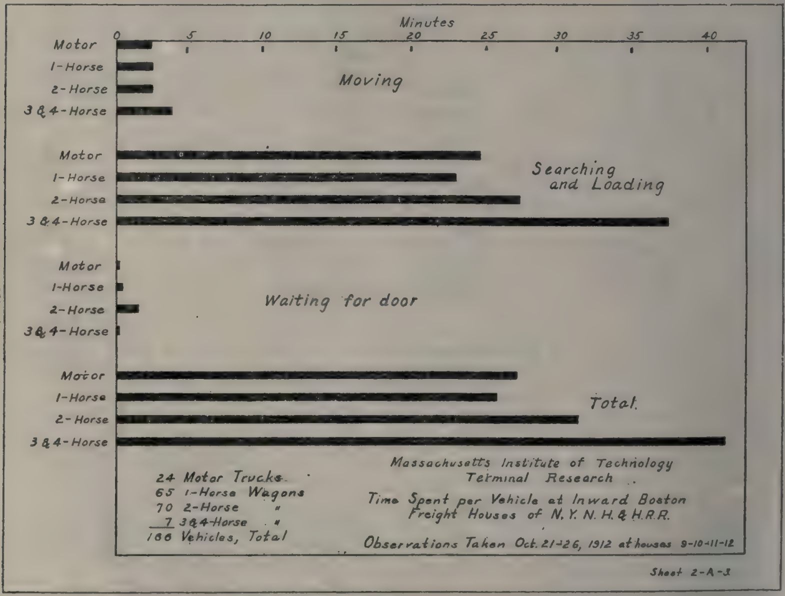

FIG. 4. TYPICAL PLOT OF TIME SPENT PER VEHICLE AT INWARD FREIGHT HOUSES

also observed. Fig. 5 shows typical "load curves"* at an inward and at an outward house. The relative volume of inward traffic during any hour is approximately proportional to the area under the "Inward" curve for that hour; similarly, the relative volume of outward traffic during any hour is approximately proportional to the area under the "Outward" curve for that hour. These curves show that about 30 per cent of the total inward traffic is between 7 and 9.30 A. M., and that about 35 per cent of the outward traffic is between 4 and 5.30 P. M. In this connection it should be noted that the entrance gates open at 7 in the morning and close at 5 in the afternoon. These curves show clearly that one of the greatest difficulties encountered by the Railroads in the handling of L. C. L. freight is the necessity of providing facilities which are utilized to their maximum capacity during only one or two hours of the day. This condition is analagous to a power plant operating at a very low load factor.

Photographs of Yards During the Rush Hours. In connection with the load curves shown in Fig. 5 numerous photographs of the yards were

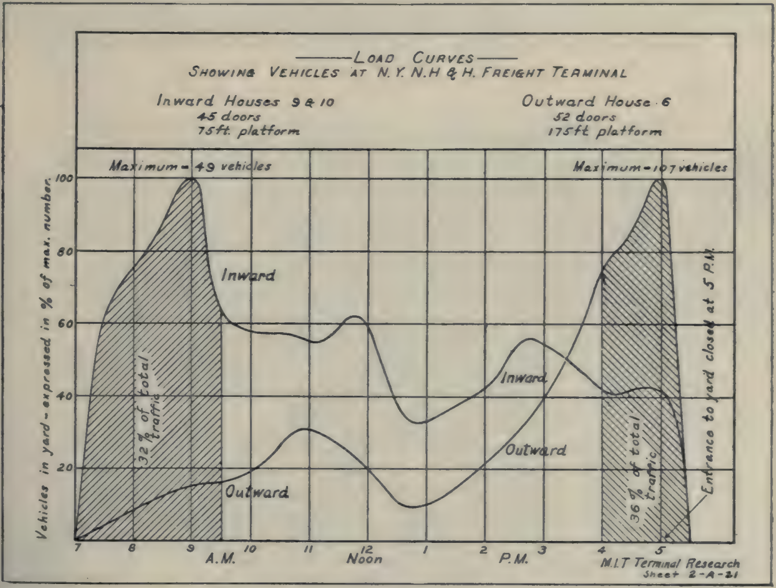

FIG. 5. TYPICAL "LOAD CURVES"

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*Similar curves for the vehicle traffic at piers in New York City are contained in the "Report on the Elimination of Surface Railroad Tracks" by E. P. Goodrich and H. P. Nichols, Committee of Engineers, New York City, 1911. One of these plots (Plate 8 in the above report) for a selected pier handling outward freight shows that of the vehicles arriving at the pier between 7 A. M. and 5 P. M., 35 per cent arrived after 3 P. M.

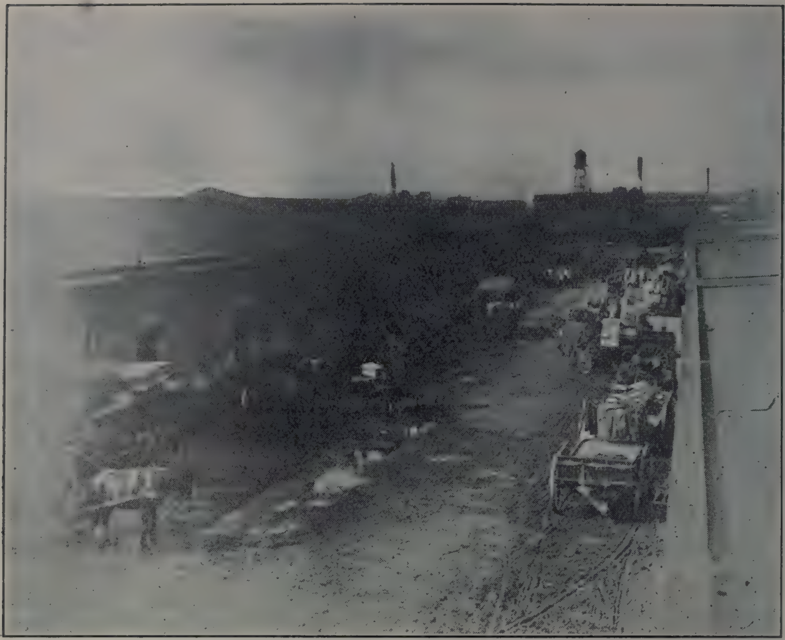

Fig. 6

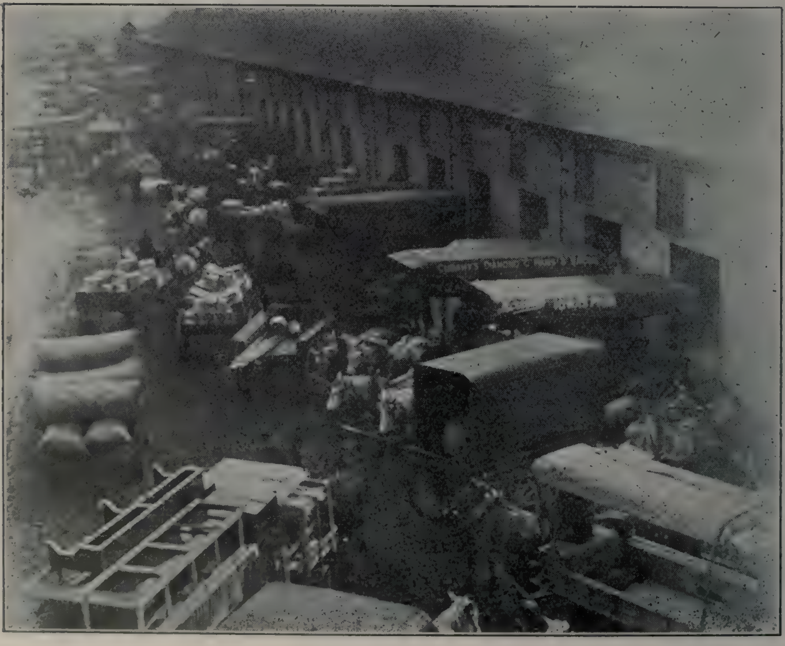

Fig. 7

taken, of which Figs. 6 to 9 are typical. The load curves can best be interpreted when considered in connection with these photographs.

Fig. 6 is a view of the roadway between two of the New Haven inward houses taken about 8.00 A. M. on April 18, 1913. This photograph shows approximately 25 teams in the yard. The maximum point on the inward curve in Fig. 5 corresponds to 49 teams in the yard; hence at the hour of maximum traffic the congestion would be twice as great as that shown in the photograph.

Fig. 7 is a photograph taken of the roadway alongside a New Haven outward house at about 5 o'clock in the afternoon of April 17, 1913. The congestion here shown is somewhat greater than that of the corresponding maximum point of the outward curve shown in Fig. 5, as the traffic on this particular day was exceptionally heavy.

Fig. 8 shows the conditions at a similar house taken earlier in the afternoon (4 P. M.) and is representative of the conditions during the greater part of the day.

Fig. 9 is a photograph, taken at about 5 P. M., of the roadway between two Boston & Maine houses in the Rutherford Avenue group. This view also shows in the house to the right the modern door construction, which makes possible the opening of practically the entire side of the house. This should be contrasted with the small doors in the older house on the left.

Lost Time Due to Waiting for Turn at Freight House Doors. A detailed study of the conditions at the freight houses was next undertaken to determine if possible what proportion of the time spent by the teamster at the freight terminal might be eliminated. The first item in the lost time is the delay due to waiting for turn at the freight house doors.

Observations were made on 475 vehicles making 590 door calls at two of the New Haven outward houses, 231 vehicles making 262 door calls at three of the Boston & Maine outward houses, and 139 vehicles making 216 door calls at two Boston & Albany outward houses, or 1068 door calls in all. The average wait per door was found to be 1.1 minutes, with a maximum wait of 35 minutes and a minimum of no wait at all. These observations were all taken in the afternoon and therefore represent the more congested portion of the day. It was found (see Figs. 2 and 3) that on the average, taking into account all the observations made, each vehicle made about 3.5 door calls per trip to the outward houses of any one road; hence the total average wait per trip was 3.5 x 1.1 = 4 minutes. This aggregate figure compares favorably with observations reported by David Beecroft in a paper presented at the November, 1912, Convention of the National Association of Automobile Manufacturers, on the

FIG. 8

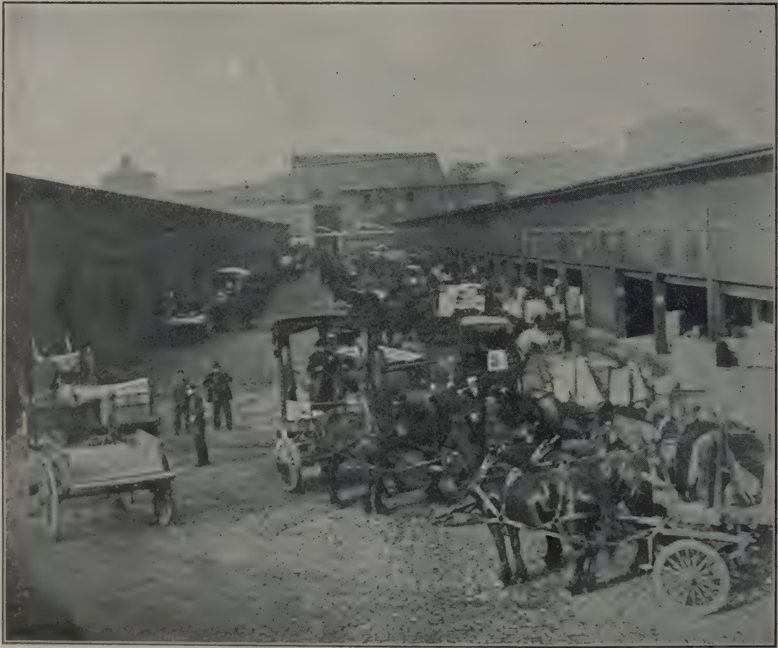

FIG. 9

delays at the outward railroad freight terminals in Chicago and Detroit, and at the docks in New York City, in all of which terminals the "single dump" system is employed. Mr. Beecroft gives an average wait of 6.2 minutes at the Santa Fe Terminal in Chicago, 11.7 minutes at the Illinois Central Terminal in Chicago, 3.0 minutes at the Coopers St. Terminal in Detroit, and 12.5 minutes at the Jersey Central Dock in New York City.

Similar observations were made at the inward freight houses during a number of forenoons. The total number of door calls covered by these observations was 878. The average wait per door was 0.6 minute, the maximum wait was 41 minutes, and the minimum wait was none at all. It was found (see Figs. 2 and 3) that on the average each vehicle made 2.5 door calls per trip to the inward houses of any one road; hence the total average wait per trip was 2.5 x 0.6=1.5 minutes.

Other Lost Time at Inward Freight Houses. The time spent in waiting for turn at the freight house doors is the only lost time at the outward houses chargeable to the railroad. At the inward houses, however, there may be in addition to delay in waiting for turn at the freight house door additional lost time due to the following causes:

1. Inquiries at cashier's office.
2. Loafing of driver at the cashier's office and in the freight house.
3. Searching for freight by driver.

Data regarding the first two of these items, namely, the time consumed in inquiries and in loafing were obtained by two sets of observations, one made at the New Haven Terminal (December, 1912) and the other at the Boston & Maine Terminal (March and April, 1913.) The results of these observations are recorded in Table I. At the same time data on item (3) were also obtained, which, however, were supplemented by more extended observations at other times.

TABLE I.

ANALYSIS OF TOTAL TIME SPENT BY WAGONS* AT INWARD FREIGHT HOUSES

Number of wagons observed	88
Average number of house calls per yard call	1.3
Average number of door calls per yard call	1.8
Average number of pieces per wagon	23
Average weight per piece, in pounds (approx.)	120

Item	Av. time per wagon in freight yard	
	Minutes	Per cent
CASHIER'S OFFICE:		
Checks	3.8	8.1
Inquiry	2.8	6.0
Loafing	1.9	4.1
	8.5	18.2
FREIGHT HOUSE DOOR:		
Giving receipt and making inquiries of Delivery Clerk	2.2	4.7
Searching (including calls without loading)	4.1	8.9
Loading	16.2	34.8
Delay at door	0.5	1.0
Helping other drivers	1.0	2.1
Roping, etc.	2.3	4.9
Loafing	1.6	3.4
	27.9	59.8
Moving in Freight Yard	10.3	22.0
Total	46.7	100.0

*These wagons on the average carried somewhat lighter loads than those on which the data given in Figs. 2 and 3 were obtained.

The general plan of making observations recorded in Table I was to pick out wagons at random as they called at the cashier's office for their delivery checks and follow them during the time the wagons were in the freight yard. The period of time observed was from the stopping of the vehicle at the cashier's office until the passing of the last freight house on leaving the yard. The wagons on which these observations were taken were all owned by small teamsters, and all stopped at the cashier's office before going to a freight house. Some of the master teamsters, such as those owning the wagons on which the data in Figs. 2 and 3 were taken, maintain foremen or "lumpers" at the different yards; in such a case the lumper gets the delivery checks for his company at the cashier's office and distributes them among the drivers of his company, thus eliminating the necessity of each driver visiting the cashier's office. As a class, the wagons of the smaller teamsters, or those of companies which do not make a business of freight hauling, do not handle as large loads per trip as do the wagons of large trucking companies, so that the total time of loading and the number of door visits per trip as given in Table I are smaller than the typical values for the master teamsters shown on Figs. 2 and 3.

Inquiries at Cashier's Office. These observations showed that 6% of the total time in the freight yard was consumed in making inquiries at the cashier's office. These inquiries at the cashier's office are due chiefly to two causes: (1) obtaining "memorandum" checks for shipments whose delivery checks were not as yet available to the teamster; (2) correcting errors on delivery checks as discovered by the driver. As a large proportion of the calls at the inquiry windows were for memorandum checks, any improvement in the system of handling the regular delivery checks whereby the number of memorandum checks could be reduced would greatly aid the teamster.

Loafing of Drivers. The time spent by the driver in loafing at the cashier's office was found to be an appreciable item, particularly on cold days. This source of lost time is, of course, in no way chargeable to the railroad. The average loafing time at the cashier's office at the time of the observations recorded in Table I (December, March and April) was 7% of the total time in the yard. In this connection it may be remarked that the driver is the prime factor in the freight terminal situation, as his complete co-operation is necessary for the success of any freight house system.

Searching for Freight. From the observations recorded in Table I, the average time spent by the driver in searching for freight in the freight house was 9% of the total time in the yard, or 15% of the time at the freight house door. An earlier set of observations made in November, 1912, on 159 door visits at four other freight houses of the New Haven and the Boston & Maine showed an average delay due to searching of 21% of the time at the freight house door. The average searching time for all these observations (318 door calls in all) was 18% of the time at the freight house or approximately 11% of the total time in the yard.

In some instances the time charged to searching was time spent by the driver in locating freight for which the delivery check was not available and which he wished to remove on a memorandum check. A part of the searching time was also due to the crowded conditions of the houses, but the chief causes were scattered consignments and neglect to place the pieces of freight so that the identification marks could be read easily. In some cases searching was due indirectly to the poor manner in which the goods had been packed and marked by the shipper; in the rehandling packages had become so battered that the addresses were almost unrecognizable.

It frequently occurs that a consignment of goods billed in a certain car will actually arrive in several cars and will, therefore, be scattered in the freight house when unloaded. The remedy for this lies at the point of loading rather than at the destination. Since these observations were taken, considerable improvement has been made in the conditions in the freight houses. One road has put on "sorting gangs" whose duty it is to keep the freight properly sorted and to move forward each night all uncalled for consignments.

Door Calls Without Loading. In making the various observations referred to above it was found that a wagon frequently called at a door and then left without loading any freight. To determine the extent of this practice and the causes therefor, two sets of observations were made in October, 1912, one covering a total of 267 door calls at typical New Haven houses and one covering a total of 221 door calls at typical Boston & Maine houses. It was found that of these 488 door calls, 107 calls, or 22% of the total calls, were ineffective as far as the actual loading of freight was concerned. The maximum time occupied for such a call was 69.5 minutes, the minimum 0.2 minute and the average for the 107 calls was 6.8 minutes. To this should be added the time spent by the wagon in going from the wrong door to the right one, which on the average is probably not over 1 minute. The average time lost per door on this account including all calls (486) was 1.4 minutes at the door itself, or allowing for moving to the right door, the average delay would be 1.7 minutes.

These extra door visits were found to be due to (1) omission of door locations on the delivery checks, (2) errors on the delivery checks, and (3) errors by the drivers. In certain cases the omission of door locations arose from the fact that the railroad's office work was ahead of the yard work, and the drivers preferred to obtain the delivery checks without locations designated and to search for the freight, rather than wait for the office to receive the location. The errors on the delivery checks were found to be due to carelessness in making out the checks, to illegibility of the waybills from which the checks are made, or to the shifting of a car before it was unloaded to a position other than that reported to the cashier's office.

The above facts in regard to the extra door visits were called to the attention of the railroad officials, who demanded greater care by the clerks in marking the door locations on the checks. A subsequent (March, 1913) series of observations made at the New Haven houses showed that the percentage of these extra door calls had been reduced from 22% to 12.5%, the latter figure being an average for 390 door calls. The corresponding average time wasted per door call, including all calls (390), was reduced from 1.4 to 1.0 minute.

Conclusion as to Possible Improvements. In order to summarize the above observations and to indicate how much time might be saved to the teamster by possible improvements in the methods of delivering and receiving freight at the freight houses, the following table (II) has been drawn up, based on all the observations recorded above. The table refers to the average conditions as they existed in the freight houses at the conclusion of our observations (October, 1913,) and to two-horse wagons regularly employed in trucking miscellaneous freight.

In the columns headed "Possible Reduction by Railroad," are given the reductions in time which, in our opinion, would result from improvements which might reasonably be carried out by the railroads. No additional houses and no radical change in the general system of receiving and delivering freight are contemplated, but only such changes as might be made to improve the present system. It should be borne in mind that improvements cost money; it is beyond the scope of this paper either to estimate the cost of the suggested changes or to discuss the question of what proportion of this additional expense should be borne by the railroads without additional compensation.

TABLE II.

ESTIMATED DISTRIBUTION OF TOTAL TIME IN YARD FOR AVERAGE TWO-HORSE WAGON

(Wagon receiving freight calls on the average at 1.5 houses and at 1.5 doors per house. Wagon delivering freight calls on the average at 2 houses and at 1.75 doors per house.)

Distribution of time	Time in yard for wagon to obtain load, minutes			Time in yard for wagon to deliver load, minutes		
	Present	Possible reduction by railroad	Net time after reduction	Present	Possible reduction by railroad	Net time after reduction
Obtaining checks	4	..	4	..	..	..
Receipts and Inquiries	5	2	3	..	..	..
Waiting for door	1.5	..	1.5	4	1	3
Searching for freight, including calls without loading	8	5	3	..	..	..
Loading or Unloading*	35	5	30	25	4	21
Loafing	3.5	..	3.5	..	..	..
Moving in freight yard	10	1	9	10	1	9
Total	67	13	54	39	6	33

*The time for loading and unloading is based on the average of all observations taken, including those summarized in Figs. 2 and 3 as well as those given in Table I.

Obtaining Checks. This item includes the time spent by the teamster at the cashier's office in obtaining delivery checks and settling bills. The time of 4 minutes could not be reduced appreciably.

Receipts and Inquiries. This item includes the time spent by driver in making inquiries at the cashier's information desk, in telephoning about lost shipments, and in giving receipt to delivery clerk and in making inquiries in freight house. This time of 5 minutes could be reduced materially by the exercise of greater care in making out the delivery checks. As noted above, errors in the delivery checks are frequently due to errors or illegibility of the waybills (made out by the railroad) which are used in making out the delivery checks; errors in the waybills are in turn frequently due to errors or illegibility in the bills-of-lading (made out by the shipper.) The possibility of errors in the delivery checks would be reduced if the railroad used billing machines for making out the waybills, for the name and address of the consignee and the description of the goods could then be entered on the delivery check as a duplicate of the entry on the waybill. Errors in both delivery-checks and waybills would also be materially reduced if shippers adopted the practice of making out bills-of-lading by typewriter instead of by hand, as is now common even with large houses.

The time taken by the driver in obtaining the railroad's receipt for outward bound freight is included under unloading time for wagons delivering freight.

Waiting for Turn at Door. Contrary to statements made frequently by drivers that they lose large amounts of time due to waiting for their turn at the freight house doors, this item was found to be surprisingly small, viz., an average delay of 1.5 minutes for inward and 4 minutes for outward freight. The delays observed were chiefly during the rush periods in the morning at the inward houses and in the afternoon at the outward houses, and even at these times the length of delays was not excessive (see page 11.) The number of available doors in the freight houses is more than adequate for traffic *except* during these brief morning and evening rush periods.

It is doubtful whether the average delay of 1.5 minutes per yard trip to the inward houses could be materially reduced, although greater care in locating the freight in the freight houses and in making out the delivery checks, as discussed in the next paragraph, would cut down the number of door visits per trip, which in turn might relieve the rush hour congestion somewhat. It is impossible to estimate how much of a reduction might thus be effected, since it frequently happens that this delay is due to a driver waiting for a particular door, even though other doors in the same house are not occupied.

Searching for Freight and Calls Without Loading. The action of one road in putting "sorting gangs" in the freight house has proved beneficial to both the teamster and the railroad, giving more space for the unloading of the cars and keeping consignments from being covered up by freight arriving subsequently. Were this improvement carried out in all freight houses the average searching time could be reduced materially. By avoiding the errors in the delivery checks as noted below, the unnecessary calls at doors without finding the freight would be partly eliminated. By having the regular delivery checks made out ready to receive the door locations as soon as the freight is unloaded, these checks could be racked at the cashier's office almost simultaneously with the placing of the freight in the houses, and thereby reduce the number of memorandum checks and the time spent by drivers in hunting for freight which may or may not be in the house.

A certain amount of time must inevitably be required for the driver to locate his freight, but with more efficient methods of handling the freight in the freight house and in making out the delivery checks the average searching time per trip could, in our opinion, be reduced from 8 minutes to about 3 minutes.

Loading or Unloading. This is the portion of the time at the freight house spent by the teamster in handling freight. The time at present consumed could be materially reduced by a closer co-operation between the employees of the railroads and the teamsters. The employment of more truckmen in the freight house to assist the drivers in handling the bulky loads would improve the service by further reducing this time, though the labor expense to the railroad would be increased. A reduction of the present times for loading and unloading by about 15% could, in our opinion, be expected from a reasonable improvement in co-operation and increase in the number of truckmen.

In none of the above discussion have the methods of handling freight known as the "single dump" and the "sill delivery" been considered. It is an open question if the saving in the time of the drivers which might result from the institution of these methods would justify the necessary increase in the labor cost in the freight houses.

Loafing. The time spent by the drivers in loafing while at the cashier's office and in the freight yard is not chargeable to the railroad and, therefore, would not be affected by any readjustment of the methods of operating the freight houses. Loafing time depends on the season of the year, being greater in extremely hot or cold weather than when the temperature is normal.

Moving in Freight Yard. This item represents the time that the wagon is moving while in the freight yard; that is, between the passing of the first and the last freight buildings in the given terminal. This time is relatively large at the Charlestown yards on account of the scattered locations of the houses. The moving time in these yards could be reduced somewhat by using for L. C. L. freight those buildings which are nearest the business center of Boston, and which are now used for car-load freight. Several times as many wagons call per day at one of the L. C. L. houses as call at one of the car-load houses. The moving times of the wagons would also be reduced if the street paving alongside the houses was kept in better condition. The paving on some of the private ways in the yards is filled with ruts which collect ice and water during bad weather. On some of the public streets, there are curbstones which make it inconvenient to back wagons to the freight house doors. Even were improvements in these respects carried out it is doubtful if the *average* moving time could be reduced by more than 10%, or say one minute; although at some of the houses a much greater saving could be expected.

Total Reduction in Time of Yard Visit. The total possible saving of the teamster's time as represented in the above table is, in round figures, 18%, or between 1/6 and 1/5 of the time now spent by him in the freight yards. The changes in the operation of the yards as pointed out above might be expected to result in a considerable increase in the capacity of the railroad's present terminal facilities for handling L. C. L. freight. This saving in time is not as important to the teamster when considered in connection with the total working day of the wagons as might at first appear. As the wagons at present spend only 1/3 of the day in the freight yard, a reduction of this yard time by as much as 1/5 would mean a saving of not more than 7% of the total working day. In other words, the study has shown that reasonable changes which the railroads might make in their present system of receiving and delivering miscellaneous freight, would effect a saving for the operators of the teams of a maximum of 7% of the working day. As already pointed out, the cost of making these changes has not been considered in this connection, but merely the possibility of the railroads' rendering improved service with their present house equipment. It is pointed out above that the average delay of wagons was greater at the warehouses than in the railroad yards; the shippers themselves can therefore influence the lost time of wagons to a greater extent than can the railroads.

Underloading of Wagons Handling Inbound Freight. The study has also furnished information which suggests a lack of efficiency in the present system of moving miscellaneous freight between warehouse and freight house. Data obtained on loads taken from the inward houses of the Fitchburg Division of the Boston & Maine terminal by 63 one- and two-horse wagons, (included in the observations given in Table I) showed that these loads averaged slightly less than 3000 lbs.* This is approximately one-half of the normal capacity of these wagons for the Boston conditions of grade, pavement and distance. Any system of trucking whereby an increase in this average load could be effected would cause a corresponding decrease in the number of teams required to handle the same traffic. The "store-door" delivery** by the railroads might provide a means of reducing this lack of efficiency.

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*This average weight per wagon load is probably typical of a large number of railroad terminals. Mr. V. S. Curtis has stated to the authors that the analysis of the miscellaneous shipping of a large New York City business showed that the average weight per load of outward freight was approximately 1700 lbs. and of inward freight approximately 2800 lbs.

PART II.

ANALYSIS OF TIME BETWEEN ARRIVAL OF TRAIN IN YARD AND DELIVERY OF FREIGHT.

The time elapsing between the arrival of a freight train in the yard and the time of delivery of the L. C. L. freight to the teamster is an important item in the rendering of quick service by the railroad. This is particularly true of the railroads which enter Boston, for an unusually large portion of their freight is hauled less than 250 miles. A study of the times for the several operations made in the yard, office and freight house in handling inbound miscellaneous goods was made at two of the Boston Terminals, viz., the New Haven Terminal and the Portland Division Terminal (Rutherford Ave.) of the Boston & Maine. Observations at each of the two terminals covered all of the L. C. L. or house cars handled in a single typical day.

Office Procedure with Respect to Notices and Delivery Checks. The general procedure at the New Haven Terminal at the time the observations were taken was as follows, beginning with the arrival of the waybills. The waybills arrive at the office of the Boston freight agent either on the train bringing the freight or on other trains arriving earlier. In the latter case, the waybills are held until the office receives notice of the arrival of the freight train in the yard, i.e., until the train is "booked" at the office. From the waybills corresponding to the cars in a particular train, clerks make out the notices of arrival, the delivery checks, and the freight bills. The notices of the arrival of the freight are sent to the consignees by mail or messenger, except those whose teamsters call at the freight yard so frequently that it is unnecessary to send notice to them of the arrival of the goods. The delivery checks are sent from the freight agent's office to the cashier's office in the freight yard by chute or messenger. In the meantime the L. C. L. cars have been placed at the houses in the yard, unloaded by unloading gangs, and the door location of each car reported to the cashier's office. The door locations are then noted on the delivery checks by a clerk in the cashier's office, and the completed check is placed in a pigoen hole at the cashier's window, i.e., the check is "racked."

**If a "store-door" delivery service were to be established by a railroad, it would appear reasonable that the railroad should charge for such service. The practice of free delivery of certain classes of shipments into Baltimore and Washington grew out of peculiar conditions which formerly existed at these points; see Interstate Commerce Commission report upon Washington, D. C., Store-Door Delivery, June 17, 1913. (Opinion No. 2353.)

A driver must go to the cashier's office and there pay the freight charges in order to obtain the delivery check. If he is a credit customer, he may obtain the delivery check without paying the freight charges at that time. In order to obtain the consignment, the driver must present this delivery check to the clerk in the freight house. This procedure is departed from in the case of perishable freight, and in certain other instances, a memorandum check, as described on page 5, being issued to the driver in lieu of the regular delivery check.

At the Portland Division Terminal of the Boston & Maine the same general procedure is carried out, except that the making out of the delivery checks is commenced as soon as the waybills have arrived, irrespective of whether the freight is in the yard or not. This difference in procedure arises from the fact that a majority of the waybills at this terminal arrive in advance of the freight, whereas, at the New Haven Terminal the opposite is true.

Number of Consignments of L. C. L. Freight Covered in Observations of Yard and Office Movements. The observations discussed below were based on the complete record of 2919 separate consignments arriving in 241 cars. The weights and the distribution of the consignee's notices for these consignments are given in the following table, together with data on the number of cars and the time of arrival.

TABLE III.

Data on L. C. L. Consignments Arriving in 1 Day (Approximately 24 Consecutive Hours)

	N. H.	B. & M.
Number of trains with L. C. L. freight	20	17
First train arrived	1 A. M.	3 P. M.*
Last train arrived	1 P. M.	7 A. M.
Number of L. C. L. cars in day's business	120	121
Average load per L. C. L. car, tons	6.2	3.9
Number of consignments	1892	1027
Average weight per consignment, pounds	788	927
Consignees sent notices by mail	491	251
Consignees sent notices by messenger	683	133
Per cent. of consignees sent notices	62	37

Time Records Made. Time records were obtained at the two terminals upon each of the following yard, office and house movements for each of the 2919 consignments, except items (10) and (11) which were obtained on only the 1027 consignments handled at the Portland Division Terminal.

*On day before delivery checks were racked.

YARD MOVEMENTS:

(1) Arrival of trains in yard
(2) Setting cars for unloading
(3) Unloading started
(4) Unloading completed

OFFICE MOVEMENTS:

(5) Arrival of way-bills at office
(6) Train booked at office, or arrival of train sheets at office
(7) Locations received at office
(8) Delivery checks completed
(9) Delivery checks racked at cashier's office

HOUSE MOVEMENTS: (Portland Div. Terminal only)

(10) Delivery checks delivered to teamsters at cashier's office
(11) Freight consignments delivered at freight house door

A summary of these records is given in Table IV.

Discussion of Time Interval Between Arrival of Train and Racking of Delivery Checks. In studying the figures given in Tables III and IV, the following facts should be borne in mind:

(1) Practically all of the freight coming into Boston over the New Haven from points outside of New England, other than New York City, comes through the Harlem River and Maybrook gateways. It will be noted from Table IV that the overall times for such "foreign" consignments was much greater than for consignments from New York City and New England points. The difference in the overall times for these two classes of trains arises from the fact that a special effort is made to get out the delivery checks and unload the "local" cars as quickly as possible, which frequently necessitates the sacrificing of promptness for similar operations on "foreign" cars. A like condition does not arise at the Portland Division Terminal because all the L. C. L. freight received there is from New England points.

(2) Seven of the 17 Portland Division trains arrived between 3 P. M. and 1 A. M., whereas the first New Haven train did not arrive till 1 A. M. The last B. & M. train arrived before 7 A. M., whereas 5 of the New Haven trains arrived after that hour, one of these being the heavy Fall River Line train from New York City.

(3) An effort is made at the Portland Division Terminal to rack the delivery checks for the master teamsters as early as possible, irrespective of whether the location for the car in question has been received or not, or whether the car is unloaded or not. This is also done, but to

TABLE IV.

TIME IN HOURS FROM ARRIVAL OF TRAIN TO DELIVERY OF FREIGHT

(For the first three items the maximum and minimum times are per car; for the other items, the maximum and minimum times are per consignment.)

Time Interval	Boston & Maine Portland Division, L.C.L. Freight			New Haven, L. C. L. Freight						
				From New England and New York City			From Outside New Eng., except N.Y.C.			Average for all Cars
	Minimum	Maximum	Average	Minimum	Maximum	Average	Minimum	Maximum	Average	
Night and Day Hours										
Arrival of train to setting of car	0.7	13.5	4.0	3.0	6.2	2.8	3.7	18.6	7.0	3.4
Setting of car to unloaded started	0.0	24.2	2.6	0.0	26.3	2.2	0.2	22.1	6.7	2.8
Time of unloading car	0.1	1.8	0.5	0.1	1.6	0.7	0.2	2.8	0.9	0.7
Unloading completed to delivery checks racked	—20.8*	23.1	0.8	—1.5*	26.2	1.8	0.4	29.6	6.6	2.3
Arrival of train to delivery checks racked or unloading completed, time to the latest of the two operations	2.0	28.4	8.6	1.2	33.1	7.5	7.3	28.8	21.2	9.2
Delivery checks racked to delivery checks delivered	0.0	67.9	7.8	....	....	....	....	....	....	....
Delivery checks delivered to freight delivered	0.1	49.3	10.1	....	....	....	....	....	....	....
Arrival of train to freight delivered	2.1	145.6	26.5	....	....	....	....	....	....	....
Day Hours only (7 A. M. to 5 P. M.)										
Unloading completed to delivery checks racked	—6.8*	9.1	—0.8*	—1.5*	12.2	1.2	0.4	7.7	3.0	1.5
Arrival of train to delivery checks racked or unloading completed, time to the latest of the two operations	0.0	12.0	3.2	0.0	14.5	3.9	5.1	13.1	10.0	4.7
Arrival of train to freight delivered	0.0	50.0	13.4	....	....	....	....	....	....	....

*Delivery Checks were racked before unloading was completed.

a smaller extent, at the New Haven Terminal. The master teamsters desire to receive their delivery checks early in order to plan their day's work, and they ask that this method be followed for their benefit. This accounts for the "negative" time in the item for "Unloading Completed to Delivery Checks Racked" in Table IV, the negative time meaning that the delivery check was racked before the unloading was completed. In making up the average time for the item of "Unloading Completed to Delivery Checks Racked," the time intervals between the racking of delivery checks and the completion of unloading, when this was the order of events, were taken as negative. The average time thus obtained was 1.8 hour for the New Haven "local" freight as compared to 0.8 hour for the Boston & Maine.

Confining our attention to the "local" freight, the total average time for freight from New York City and New England points arriving by the New Haven and the Portland Division of the B. & M. was approximately 8 hours between the arrival of a train and the racking of delivery checks or the completion of the unloading (depending upon which of these two operations occurred latest.) From 3 to 4 hours elapsed between the arrival of the train and the setting of the car for unloading. About 2½ hours elasped between the setting of the car and the beginning of the unloading. The unloading required from ½ to ¾ of an hour, and an additional time of from 1 to 2 hours elapsed before the delivery checks were racked, or, in other words, were available to the teamster. Of these operations, the shortest was the time required for unloading the car and the longest was the time between the arrival of the train and the setting of the car. The variation from the average figures just quoted was surprisingly large, the maximum time intervals in some cases being 10 or more times the average. It is these maximum time intervals which cause the greatest amount of dissatisfaction among the teamsters and shippers, who are prone to remember one excessive delay and fail to take into consideration the time required on the average. The fact that the maximum time intervals are so much greater than the average shows that these maximum time intervals are of comparatively rare occurrence.

The time and money available for this study were not sufficient to enable us to investigate in detail the causes for the excessive delays nor to determine whether by changes in the methods employed in the offices and yards the average times might be reduced. One point, however, which became apparent in our investigation was that the more general adoption of the practice of making out the delivery checks from the waybills as soon as they arrive, instead of waiting for the train to reach the yard, would result in a considerable saving in time to the teamsters and would also render unnecessary the issuance of so large a number of memorandum checks. This system is carried out at the Portland Division Terminal, but at the time of our investigation was not in use at the New Haven Terminal. At the New Haven Terminal the freight was available on the floor of the freight house approximately 2 hours on the average before the delivery checks were racked, whereas in the Portland Division Terminal less than an hour on the average elapsed between the conclusion of unloading and the racking of the delivery checks.

Time Interval Between the Racking of Delivery Checks and Removal of Freight by Teamster. Consignees are allowed 72 hours from 7 A. M. on the day after that on which the notices of arrival of the freight are sent out before storage charges begin. The observations recorded in Table IV on the Portland Division Terminal were extended to cover the time between the racking of the delivery checks and the delivery of the freight to the teamsters. On the average this total interval was approximately 18 hours, this average being taken solely for the consignments delivered during the free storage period. Of the 1027 consignments observed, however, 54 or 5.3% incurred storage charges; that is, were not called for until after the third day. The total of these 1027 consignments amounted to 476 tons, of which 22.5 tons or 4.7% incurred storage charges.

In this connection data were also obtained on the time intervals between the obtaining of the delivery checks by the drivers and the removal by them of their freight from the freight house. The results are summarized in Table V. Of the 811 delivery checks obtained on the day that notices were sent out, 597 were called for at the cashier's office before noon, indicating that a large proportion of the freight is called for by contract teamsters who make regular visits to the cashier's office each day.

TABLE V.

TIME OF TEAMSTERS' OBTAINING DELIVERY CHECKS AND CONSIGNMENTS

Disposition of Checks and Consignments	Delivery Check Obtained		Consignment Obtained	
	No. of Consignments	% of Total	No. of Consignments	% of Total
On day that notices were sent......	811	79.0	569	55.5
1st day after notices were sent....	115	11.2	255	24.8
2nd day after notices were sent....	35	3.4	101	9.7
3rd day after notices were sent....	26	2.5	48	4.7
Incurred storage charges....	40	3.9	54	5.3
Total................	1027	100.0	1027	100.0

Free Storage Abuse. A study of Table V brings out very clearly the practice on the part of some of the consignees of abusing the 3 day's free storage privilege granted by the railroads. The figures indicate a decided tendency on the part of the teamsters (or consignees) to remove the freight at their own convenience, though they have already obtained the delivery checks. This conclusion was also confirmed by determining the tonnage left in the freight house for 22 hours or more after the delivery checks for this freight had been obtained at the cashier's office. It was found that 15% of the total tonnage arriving at the terminal on the day observed was left in the freight house for at least this length of time. (This 15% does not include the 5% of the day's business which contracted storage charges.) For this 15% of the freight the railroad is obliged to act as a free storage warehouse. One possible solution for this free storage evil would be the establishment of the "store door" delivery, whereby the railroad itself delivers the freight, as has been operated for several years in Washington and Baltimore.

Underloading of L.C.L. Cars. Another item of possible inefficiency from the railroad's standpoint is shown by the average loads of the L. C. L. cars given in Table III. The average load was approximately 6 tons for the L. C. L. cars arriving at the New Haven Terminal, and approximately 4 tons at the Portland Division Terminal of the Boston & Maine. This indicates that the tonnage of miscellaneous freight carried on these trains is only about 20% of the normal capacity of the cars. The question of the expense of handling this surplus equipment as compared to the time and expense of concentrating the shipments in fewer cars or possibly in smaller cars than are now being operated, would be a fruitful topic for further study.

DISCUSSION AT MEETING OF NEW YORK RAILROAD CLUB

The PRESIDENT—Dr. Pender, you will have an opportunity at the end of the discussion to sum up this matter. Please note whatever transpires, so that you may reply to any criticisms or questions which may be raised.

A number of gentlemen have volunteered to discuss the subject of the paper, and among the first I will call upon is Mr. E. D. Rushmore, Engineer, Power & Mining Department, General Electric Company. Mr. Rushmore, gentlemen.

MR. D. B. RUSHMORE—The subject of freight handling is one of great present importance. When in Hamburg a few years ago I first became interested in this subject through the installation at the docks in that city, and since then have been following the problem with much interest and have had an Engineer associated with me who has devoted his entire time to the study of the handling of package freight in our railway and steamship terminals. The result has been to partially define the problem and to bring about the development of a few pieces of apparatus which fit into part of this field.

In electrical work a very large amount of attention has been paid to the production of the power, and savings of a fraction of a per cent.

in economy of power generation are considered noteworthy achievements. Comparatively little scientific study has been given to the problem of distribution of this energy, where approximately three times the investment cost and three times the operating expense, in comparison with the production end, are located.

The subject of the transmission of power has also been well worked out and with our present methods does not seem capable of very great improvement in efficiency. When, however, we get to the distribution end we find an almost virgin field for study. In the production of the materials which make up package freight the same may be said to be true. Our factories and manufacturing facilities are in general on a very efficient basis. Our trunk line railroads and steamship lines transport the freight at a low cost and in a very efficient manner. It is, however, when we get to the terminals and to the distributing systems lying beyond them that we find the same condition which holds true in the electrical field.

In general, we find that the cost of distribution is a very appreciable percentage of the cost of production and frequently many times larger, so that it is in the terminals and in the distributing systems, from there to the consumers, that the great opportunity lies for reducing the cost of freight handling.

At the present time the railroads are seeking for an increase in their incomes from the freight service, and the suggestion has been made that instead of increasing the freight rates a terminal charge be added to the present transportation charge, and this would seem like a logical act. The charge for collection and distribution, as well as the terminal charge, is entirely independent of the distance through which the freight is transported, and while at present not all of these charges are borne by the railroad it may be that at some time in the future they will be, and they are certainly all of them paid for by the ultimate consumer.

After spending many years in the study of this subject and being associated with the development of a number of devices to be utilized in this field, it has become very evident that there exists a necessity for a co-operation in a form not yet organized for the proper working out of these problems.

They involve first of all the methods of handling freight. Then the design of the terminals; the design of ships and of freight cars, and the application of a very large number of special devices for elevating, transporting and conveying packages, as well as the methods and conveyances used for the distribution from the terminal.

The large number of separate organizations involved in handling the goods received from some of our ships works against efficiency, and it does not seem improbable that at some future time this number may be decreased. There also seems to be no logical reason why railroads should not deliver the freight directly to the consumer instead of the intermediary individuals and organizations who now do it in this country.

There are probably at least a hundred different manufacturing concerns who have products which are available in this field. All of the railroads and steamship lines are interested, all of the port cities are or should be interested, and a large number of other individuals and organizations.

At the present time a number of individuals are making investigations in this line, and a number of manufacturers are advocating the special devices which they manufacture. There is no one solution to this problem, and there is no one device which is going to solve it. For instance, one of the most useful things that can be done would be as far as possible to standardize the size of box or package handled, and no doubt a great deal could be done in this direction.

A number of consulting engineers have endeavored to specialize on this work, but it does not seem as if the conditions would support them at present. Electrical manufacturers are very much handicapped in operating in this field, due to the fact that the devices which will be used in part for this work will be very largely mechanical and will be simply operated by electric motors and controllers, so that in general they will not sell directly to the users, but through the various other manufacturers of these conveying machines.

The time would seem opportune for some organized co-operative effort in this field, and suggestions as to what this should be and how it might be brought about would be of very great value at the present time.

The paper by Dr. Pender and his associates is of very great interest as showing the application of a trained mind to a special problem. There is room for a very much more extended investigation into the facts connected with this work in order that the desired improvement and reduction in costs may be brought about.

The PRESIDENT—The next speaker will be Mr. S. G. Thompson, Consulting Engineer.

Mr. THOMPSON—I have read Dr. Pender's paper with a great deal of interest and I think the railroads should be highly flattered by the results of the investigations by the Massachusetts Institute of Technology, since they absolutely refute the criticisms appearing in the paper under the caption "Object of Study." While in their conclusion the investigators made no statement as to whether or not these criticisms were justified, we find on page 21, under the caption "Total Reduction in Time of Yard Visit" that, were the suggestions proposed for increasing the efficiency of the yard adopted and put into effect, the total time saving in the day's work would be but seven per cent. Seven per cent. of a nine-hour day is approximately 38 minutes, which is not sufficient to admit of additional trips and could probably be put to no other useful purpose. Therefore, the conclusion to be reached is that the freight terminals may be assumed to run at 100 per cent. efficiency.

If I may be permitted to criticize the paper, I might take exception to the term "loafing" in referring to the time spent at the checker's office by drivers. I think if the investigators had experienced the physical discomforts of driving to and from the freight stations on a cold day, they would realize that the stopping of the driver for a few moments in the checker's office to get warm could not be classified as "loafing", but possibly as "resting." (Laughter.)

On the last page—page 28—"Underloading of L. C. L. Cars"—it is pointed out that the cars arrive at the terminals with only about 20 per cent. load. I think if the investigators had pursued the subject to the original loading point of these cars that they would find the cars are what are known as "way cars", stopping on the way and unloading part of their freight, and naturally when they arrive at the terminal they have but a small percentage of the original load, or of their total load capacity. It is doubtful if any increase of the total load carried could be made. (Applause.)

The PRESIDENT—The next speaker will be Mr. William McClellan, New York City. (Applause).

Mr. WILLIAM McCLELLAN—I am particularly glad to be here to-night, because I am very much interested in this presentation of the great subject of freight handling.

As the paper indicates, this being a railroad Club, and there being some suggestions in the paper that the railroads have not been at fault in the matter, the question arises as just how it does affect the railroads. Perhaps the immediate results would be very small if the railroads made any changes. Perhaps there could not be any very great difference made in the operating expenses so far as the railroad companies are concerned. I am not prepared to discuss this now, but I am going to speak briefly upon a few general points that have presented themselves to my mind.

You well know that the principle of co-operation is helpful to a tremendous degree. The idea of co-operation is coming in very rapidly and very forcibly. If a railroad or any other organization were to permit conditions to exist, which, while they did not immediately affect them, would cause the public or shippers inconvenience, cause them expense and trouble, we should be inclined to say that they were robbing the other fellow to that extent. Every effort is being made all along the line to bring the idea of co-operation to fruition. But there is something beyond all that. The first thought occurring to me is that there is a problem to be solved. The old idea of letting it go and letting it solve itself somehow is an exploded idea. In order to arrive at a solution of the problem we must have recognition of the analytical work such as we have to-night in this report. It means something. There is in this country the old plan of handling package freight. The methods used in this country are about as crude as they could possibly be. There is very little difference between the handling of package freight to-day and the handling of package freight 50 years ago. And it is not the fault of the railroads nor the shippers. The fault cannot be put upon any particular group of persons. We simply must grow into these things; and the point I am delighted about is that if such a paper as we have before us be recognized as giving the proper method of bringing about a solution, namely, the analytical method, then we have made a good beginning.

The second point with which I am delighted is that a technical school has joined with the railroads in trying to solve this problem. In dealing with a problem of this kind a new type of man is absolutely essential. Those who have to run a freight depot, handling the cars and pushing things through, able and efficient as they usually are, are certainly not the men to solve a problem of this sort. Some one else has to get into it. I do not want to discuss to-night anything about outsiders such as consulting engineers, but certainly it is fine to think that this work can be given into the care of university men who have had experience in general research work. Those men can study the subject, evolve a plan to bring about practical results. I hope that this is going to continue and that we shall have the earnest co-operation of the railroad experts, whose experience in dealing with these problems will help bring about the best solution; that there is to be a happy combination of the two.

The next feature is that it is intensely practical. We have had, first of all, much talk about the railroads saving a million dollars a day. No doubt all sorts of stunts can be done with the railroad systems of the country. Every railroad man in the country knows that all sorts of things can be accomplished. There is not a railroad man in this room who does not know about certain leaks and losses upon which he could put his finger in his own department and which he sincerely wishes could be stopped. But, at the same time, it is very hard to decide just where to begin. Nevertheless, we have had that kind of criticism. Little of this criticism has been constructive and suggestive. We all know that this is not the correct process. We also know that after all it is the problem that is before every railroad operating man in the country. It is his principal object in life to bring about a solution. Again, I must call your attention to the necessity of bringing other minds of a different type to help solve the problem.

The important point that I want to bring out is when a group of trained research men go at a problem like this, and make their investigations thoroughly, their reports are very different from those we have had heretofore. They are free from all criticism not founded on data, without investigation, and given out haphazard, such reports are made in a helpful spirit and in the hope of progress and improvement. When we get somebody who knows the railroad game thoroughly, to take up these recommendations and make the application, and find out how to make use of what has been learned in the nature of a solution of the problem, then we may obtain results.

Now, let us go back for a moment to consider this report. Perhaps that seven per cent. we have been talking about would not mean any more trips per day to the truckmen; but the fundamental statement can be made that, if by making all these improvements you can get that car and a lot of other cars out of the way—if the railroads can get rid of that freight sooner, even seven per cent. sooner than it has heretofore, there is a direct saving to the railroads; and it may be that they can handle many other cars per day and thus decrease the investments in equipment and terminal facilities. This information must be applied to the operation of terminal facilities from the standpoint of usefulness and necessity in handling freight out of the yard and depots; and the results, no matter how small they are, will lead to other lines of investigations which may change that seven per cent. to 20%. There is no limit, in my mind, as to what may come with the ultimate result of such a system as this. We may come to totally different methods of handling freight, and it may lead to all these internal systems of carriage with electrical contrivances about which we as yet know so little. The suggestions in this paper, the number of practical ideas given for improving the whole system of freight handling, are highly gratifying; and the only suggestion I would make to all railroad men is that they ought to be studied and acted upon. It is not merely criticism. It is a very fine piece of engineering, extremely creditable to all who took part in it, and the total expense, as you will see from the paper, was comparatively small. (Applause).

Dr. PENDER—If I may say a word here to correct an apparent misunderstanding on the part of some of the previous speakers—if you will look at the top of page 21 you will see that it is stated: "The study has shown that reasonable changes which the railroads might make in their present system of receiving and delivering miscellaneous freight, would effect a saving for the operators of the teams of a maximum of 7% of the working day." The changes referred to are such changes as could readily be made with the present facilities without excessive cost. We have not considered any such scheme as using uniform packages or mechanical devices or any scheme which is out of the range of the immediate freight house facilities of the railroad companies. Were the cost no object, a much greater saving in time might be effected, but it is an open question as to how much additional expense the railroads should be called upon to incur without receiving additional compensation.

The PRESIDENT—As this exhausts the list of our formal speakers (laughter) the subject is open for general discussion and we will be glad to hear from any one who may have anything to say on the subject.

Prof. DUGALD C. JACKSON—The variety in the forms of packages as well as of the contents thereof which one finds in the L. C.

L. freight house is almost limitless, and this great variety of material has to be taken and sorted and handled in such a way that it may be gotten through from the consignor to the consignee. If the particular freight house considered is an inward bound house, the packages must be sorted in such a way that the draymen of the consignees may readily take care of them. If it is an outward bound house, the packages must be sorted with some system respecting their ultimate destination. Mr. Rushmore has referred to Hamburg as a place at which to get ideas in regard to this matter. I do not agree with him that Hamburg is particularly well equipped to meet such conditions as are met in the average L. C. L. freight house of larger American cities, and it is not there that the best foreign suggestions may be obtained to improve our situation. If anybody will stand on the platforms of the important railway lines in the good sized cities in England or Germany where freight is handled, they may there obtain some suggestions of improvement. They cannot fail in being impressed by the way in which the package freight is there handled. However, an American observer is likely to be impressed that this is not because of better management, as much as by the fact that the package freight to be handled is classified better. This may be partially due to the fact that the foreign railroads (especially those of England) carry much of their package freight by collection and delivery rates, which make them responsible from the door of the consignor to the door of the consignee, and they consequently have the benefit of making the classifications for shipment or for delivery at the freight house with their own men, and of making their own deliveries to the store doors. Americans perhaps will never come to the collection of freight from consignors and delivery to consignees by railroad owned teams, except in some places where the freight business is distinctively of a collecting and distributing character, as in the more densely populated portions of the country. I think, however, that Americans will be clever enough to substitute some other process which will do away with a good deal of the friction which now exists in connection with the reception of freight at outward bound L. C. L. freight houses from the teamsters of consignors and its delivery at inward bound houses to the teamsters of consignees.

As to the seven per cent. saving of time which is referred to in the paper of the evening, it is not necessary to discuss very long as to whether that saving is of much importance of itself. It is an indication that small changes which may be put into effect will help to alleviate the friction which at the freight houses ordinarily exists between the railroads and the teamsters, and alleviating friction is a great aid to improving service. It means saving money as well as saving time. Consequently, improvements which Messrs. Pender and Thomson refer to will do a great deal more good than making a mere saving of seven per cent. of time.

There is another thing with respect to the foreign methods that must be considered. The English, French, German and the Danish railroads, and substantially all the other railroads of Europe are dealing with countries of relatively very dense population. The consequence is that they are doing a gathering and distributing service, as contrasted with the heavy long haul service of our western trunk lines. The foreign lines are therefore prepared particularly to carry on a freight service of the package nature and their cars are specially adapted for that purpose. Thus, for instance, the ordinary freight car of an English railroad is a truck carrying from three to five tons, or seldom over ten tons. In the case of such light trucks of the European roads, the tops are readily taken off of the covered cars so that the contents can be easily reached by means of a crane. Also, in such cases if a consignor calls for covered cars and the railroads are short of that sort of rolling stock at the time, they furnish open cars and when the goods are loaded thereon tarpaulins are placed over the goods. The railroads furnish the tarpaulins, but they also charge a rental for the use of these tarpaulins. That is, if the railroad chances not to have a convenient box car and therefore sends to the consignor an open car for a load which cannot be properly exposed to the weather, the railroad also furnishes a tarpaulin and makes an extra rental therefor. Of course, where the railroads include the collection of the freight from the consignor and its delivery to the consignee, an extra charge is made for this service over and above the railroad service from station to station.

We have relatively little territory in this country which corresponds very closely to the European conditions and our railroads have been mostly developed for long haul trunk line service. I presume that this service of our railroads cannot be matched anywhere else in the world either in reliability, rapidity or cheapness. In fact, there is no parallel to it in any part of the world when extent of traffic is considered in association with distances to be hauled. There is however, the question whether in certain parts of the American territory as much has been done as can be done in improving the package service. For instance, England and Wales have a population of 620 people per square mile of land. In Massachusetts, excluding the four western counties, there are 565 people per square mile of land. Rhode Island has 510 people per square mile of land. Connecticut has almost as many people per square mile of land as Wales. None of the other states approach this situation in respect to density of population, and this suggests that some of the railroad methods particularly successful in the densely populated foreign countries might be introduced to advantage in New England to modify the traditional American railroad practice which is so well adapted to trunk line hauling in the states of less dense population. The mere statement of the relationship of loads to the capacities of the cars used in the L. C. L. service entering Boston, referred to by Messrs. Pender and Thomson, is sufficient to emphasize this point.

Now, in respect to the introduction of electric cranes and other such devices referred to by Mr. Rushmore, I do not think that they will prove a complete panacea for the conditions of the L. C. L. freight houses unless there is associated with their introduction a distinct modification in the processes of handling the freight within the houses so that a cleaner and more satisfactory method of classifying the packages with respect to their final destination is introduced. I think that this will come about, and when this comes about, the introduction of the electrical devices will, in my judgment, prove a wonderful aid. A study of this problem (as suggested by Mr. Rushmore) by an organization specially committed to an effort to solve it for the best interests of the railroads and their shippers ought to result advantageously to all of the industries of the country. Such a start as has been made in the study at the Massachusetts Institute of Technology might be followed up and be extended, and I have no doubt that the Institute of Technology would be willing to extend it if the railroads and the shippers who are interested in the improvement of the conditions would provide the necessary funds for defraying the expenses of such an investigation. To carry on the investigation appropriately, there ought to be sufficient funds available to establish a somewhat extensive bureau that could carry on work for several years.

The PRESIDENT—Is there anyone else who has anything to say on the subject?

Mr. FREDERICK C. SYZE—I have hardly enough to say to make it worth while getting out on the floor, but what Mr. Jackson just said about classifying freight in the freight houses reminds me of a condition I observed at East St. Louis. Those of you who are familiar with the location of the freight houses of the various railroads centering there know how the L. C. L. freight is trucked across the Eads bridge into St. Louis, and what very large drays are used for that purpose. Our agent there gave ear to the criticisms of the trucking companies directed against delays to their trucks at the freight houses in that vicinity, and conceived the idea of co-operating with the teamsters. He accordingly had his forces classify the freight and assemble it close to the respectively numbered doors as it was taken from the cars. This enabled teamsters to locate and load their freight quickly and to keep moving.

If I remember rightly the time most of the trucks had been consuming at the various freight houses was something over an hour; in fact, I think it was as high as an hour and a quarter in many cases; but by co-operation our agent got the average down to about 45 minutes at his station. Naturally the teamsters preferred coming to his station because they could get more service out of their drays.

In regard to the "store-door" delivery, and while Doctor Pender qualified his reference to it, I might say that the Interstate Commerce Commission, in its investigation of the "store-door" delivery question in Baltimore and Washington about two years ago, said, among other things: "It must be said in passing that the service as now rendered at both Washington and Baltimore presents features which in the absence of further explanation appear to be grossly discriminatory." Free delivery was made on certain business and not on other, and when free delivery was made at one point inquiry was made why it was not done at other points; hence it was discontinued. (Applause.)

MR. JAMES MILLIKEN—I would like to add to the information given by the preceding speaker and for the benefit of the members of the Club that, on account of the opinion rendered by the Interstate Commerce Commission and quoted by the preceding speaker, the free store delivery at Baltimore and Washington was discontinued during the last year.

(CONTRIBUTED)

The following written comments on the paper by Mr. H. E. Watkins, Agent of the Wiggins Ferry Company at East St. Louis, and Mr. C. J. Snell, Agent of the same company at St. Louis, have been received from Mr. Charles Burlingame, Superintendent of the same company, at whose suggestion they were prepared.

East St. Louis, September 22nd, 1914.

MR. CHAS. BURLINGAME, Superintendent.

DEAR SIR:—Your letter of September 19th, file 50410, enclosing a copy of a paper to be presented before the New York Railroad Club on the delivery and handling of miscellaneous freight at the Boston Freight Terminals. As instructed in your letter, I have forwarded this paper to Mr. Snell.

This paper deals entirely with the handling of L. C. L. freight at freight depots and as this is a matter with which I have had no practical experience, I do not feel that I am in a position to make any detailed comment upon it.

I believe that this paper would be of very great interest to the agents of railroads operating freight depots in St. Louis and East St. Louis. In reading it over I notice one or two points referred to which have been before our St. Louis Association at different times. For example I attach extract from the proceedings of the Local Freight Agents Association meeting held on July 28th, consisting of a report made by committee which was appointed to look into the matter of the late receipt at freight houses of outbound L. C. L. shipments and the consequent difficulty of getting them forwarded the same day. This report contains astatement of shipments delivered to all depots for a period of five days and shows the percentage delivered in the morning and the percentage for each hour in the afternoon. The St. Louis houses close at 5:00 P. M. and the East St. Louis houses at 5:30 P. M., which accounts, no doubt, for a few shipments being shown as received between 5:00 P. M. and 5:30 P. M. This statement is made on the basis of the number of shipments and shows that about 21% of the total number of shipments are brought to the depots after 4:00 P. M.

The diagram, Fig. 5 on page 9 of the paper, covers this situation in the case of the Boston house, and is figured on the number of vehicles instead of on the number of shipments, but I presume that the ratio of shipments of vehicles is much about the same there as it is here. This diagram shows that no less than 36% of the total outbound L. C. L.

shipments is delivered at the freight house after 4:00 P. M., which shows that this trouble is very much worse in Boston than it is here.

I notice from Fig. 4 on page 8, that the proportion of one-horse wagons seems to be very high in Boston, the diagram showing no less than 65 one-horse wagons out of a total of 166 vehicles.

I notice also on page 12 that it is claimed that the delays to wagons at the Boston freight houses where they are required to distribute their freight to different points, according to destination, is less than the delay to wagons in Chicago, Detroit and New York, at all of which points the "single dump" system is in effect, under which I believe the teamster is allowed to put off all his freight, regardless of destination, at any one door. I believe that very few, if any, of the St. Louis freight houses are operated on the "single dump" system.

I regret that my knowledge of this subject is so slight that I am unable to say very much about it, and so far as I know no figures have been compiled, at any rate recently, which would enable a comparison to be made between St. Louis and Boston in the handling of L. C. L. shipments at freight houses both inbound and outbound.

Yours truly,

H. E. WATKINS, *Agent.*

Extracts from Proceedings of L. F. Agts. Ass'n., July 28, 1914.

RECEIVING FREIGHT—TIME. H–25.

Following report from the Committee was read. Moved by Mr. Weber, seconded by Mr. Brashear, that the report be received and action taken on same at next meeting.

St. Louis, Mo., July 18th, 1914.

MR. M. H. RUDOLPH, President, Local Freight Agents Association,
St. Louis, Mo.

DEAR SIR:—The Association in referring the subject of "Receipt of Freight—Time", to this committee instructed that we investigate thoroughly and report our recommendations as to the practicability of the Atlanta plan, which briefly consists of placing a stamp on shipping ticket covering shipments received after 4:00 P. M., which stamp reads "Received after 4:00 P. M., too late for forwarding this date."

Your Committee can see nothing impractical about adopting this plan at East St. Louis—St. Louis, and we further feel that the presentation of facts as disclosed by the data compiled covering period June 29th to July 3rd, both dates inclusive, showing the time freight was delivered at the warehouses during this period that we may reasonably look forward to the business interests at St. Louis co-operating with us in remedying a condition that is exceedingly expensive to the railroads and likewise to the shippers.

Below is a summary statement of shipments delivered at all depots by shippers in this territory for a period, June 29th to July 3rd, both dates inclusive.

Received between the hours		Number of Shipments	Percentage
7:00 A. M. to 12:00		36934	33.50%
1:00 P. M.	2:00 P. M.	11708	11.22%
2:00 P. M.	3:00 P. M.	14067	13.48%
3:00 P. M.	4:00 P. M.	18875	17.99%
4:00 P. M.	5:00 P. M.	20730	19.87%
5:00 P. M.	5:30 P. M.	2016	01.94%
Total....................		104330	100%

Between the hours of 7:00 A. M. and 12:00 noon, or 55.55% of the total time warehouses are open for receipt of freight, there was delivered to the warehouses 35.50% of the total shipments delivered.

Between the hours 1:00 P. M. to 5:00 P. M. or 44.45% of the total time warehouses are open for receipt of freight, there was delivered 64.50% of total shipments delivered

Between the hours 3:00 P. M. to 5:00 P. M., or 22.22% of the total time warehouses are open for receiving freight, there was delivered to the warehouses 39.78% of the total number of shipments delivered.

The late delivery of freight is recognized as one of the greatest contributors to conditions responsible for loss of entire packages and damage to L. C. L. freight and since the shippers are affected as well as the railroads, it is felt by this Committee as already stated herein, that in view of the situation reflected by these figures that the members of the Business Men's League should be given the benefit of this data and that an appeal be made to them for their co-operation to correct this condition.

A stamp such as used at Atlanta, we feel would be a step in the direction of bettering these conditions for the reason that the application of such stamp would furnish an incentive to all shippers to have their freight delivered prior to 4:00 P. M. to avoid having this stamp appear on their shipping tickets.

Mr. Charles Burlingame, Superintendent, Wiggins Ferry Company, St. Lous, Mo.

Dear Sir:—Returning all papers in your file 50410, beg to advise I am a good deal like Mr. Watkins, not having had any experience with the less than car load freight, have not given that feature very much attention. I will say though, that about two or three years ago the Business Men's League had up an agitation about delay to teams at the various warehouses and requesting the one door dump, and it is my understanding that about all the railroads in St. Louis and E. St. Louis are allowing the one door dump, which, while it saves time to the wagons, makes it somewhat more expensive to the railroads on account of the increased distance to truck the freight.

Yours truly,

C. J. SNELL, *Agent.*

The PRESIDENT—If there is no further discussion I will call upon Doctor Pender to sum up and close the paper.

Dr. PENDER—I would like to have Mr. Thomson, who is the joint author of the paper, close the discussion.

Mr. HARRY F. THOMSON—In the Interstate Commerce Commission's opinion on the Washington, D. C. store-door delivery appears the following: "No charge in addition to the published tariff for rail transportation is made for this delivery service. The tariffs of the Philadelphia, Baltimore & Washington Railroad describe it as a free service.' Such service does not apply upon shipments from other territory than that above described, nor does it apply upon a considerable number of articles within the first four classes, such as household goods, plate glass, etc." That is, the store-door delivery as at that time operated in Washington applied only to a small portion of the traffic coming into Washington.

Mr. Thompson of Newark, mentioned that the saving of seven per cent. of the teamsters' day would not enable him to make any more trips per day. I think that is really a misuse of the average figure, inasmuch as that figure is the average of a large number of wagons. One team might make two trips a day and another might make five trips. If an average of thirty-eight minutes per team per day were saved, the number of team-trips per day for the whole city would be increased. Instead of an average of three trips per day, there would be three and two-tenths trips per day, which would mean a corresponding increase in the amount of work per team. Or if the total amount of work for the city remained the same, the number of teams could be reduced.

Mr. Thompson also referred to the phraseology in the paper, suggesting that the time charged as "loafing" would better be called "resting." It makes no difference so far as the analysis is concerned whether ahe time be called "loafing" or "resting," inasmuch as it is not chargetble to the railroad as waste time. I would call attention to the fact that this time is really more than is required for a man to rest or to warm-up on a cold day. When you consider that he is taking upwards of half an hour a day it is really appreciable, as pointed out in the text, the thorough co-operation of the teamsters is one of the vital propositions in the whole freight handling problem.

Mr. Thompson also suggested the possiblity of the L. C. L. cars being fully loaded when they left their loading point, unloading at way stations en-route, and containing only a small percentage of their original load when they arrived in Boston. I think that is an error, particularly on the Boston & Maine road, where a large number of the cars are through cars. The road advertises to give "first morning delivery" from a number of points and some of their cars come from transfer points where they have been reloaded. The average of four to six tons per car is representative of the average load of the L. C. L. cars arriving in Boston, and is probably larger than the average for this class of traffic for the entire system.

Professor Jackson has referred to store-door delivery as practiced abroad. I think we have come a little closer to that than we appreciate. For instance, in Chicago on inward freight there is common arrangement between the railroad and teamsters by which the teamster takes away during the forenoon all goods which he knows are not destined to some particular teamster. A certain amount of the goods arriving for large firms is handled by regular teamsters. All goods which are not to be delivered by a known route are handed over by the railroad to the designated teamster who undertakes to deliver it.

From the paper you will notice that there is an average of approximately eighteen hours between the time that the freight is in the freight house available to the teamster and the time that the teamster takes the freight away. Meanwhile it litters up the freight house for approximately a full day, whereas the entire amount of goods could be promptly hauled away on the day of receipt if the Chicago arrangement were followed out. Thereby the house is cleared out practically every forenoon. It is a step in the direction of store-door deliveries by the railroads. The arrangement in East St. Louis, to which reference has been made, is practically of the same character. The trucking there is carried on by practically two firms, and one of the firms, I understand, issues bills of lading and also freight checks, thus acting as an agent of the carriers.

Reference has been made to the load curves, Fig. 5. As far as the paper is concerned the load curves have served as a convenient means of describing conditions; but I do not think their application is necessarily limited to being an aid in description. They remind us that some of our present customs are expensive. For instance, in New York, where the West Street conditions are probably worse than any other place in the country, there would seem to be very little reason for not changing the system of receiving and delivering freight to a twenty-four hour service. A continuous service would require the employment of additional labor by railroads, teamsters and shippers, just as is done in the handling of trains at night; but such a service should be cheaper in the long run because the property investment charge per hour of use would be less than at present.

In conclusion, I think we may refer to Mr. McClellan's remark as having hit the nail on the head; that is, the paper indicates the possibility of applying analytical methods to a complex problem of this sort. The authors have not tried to suggest remedies to freight house troubles; but if the paper emphasizes the possibility of analyzing some of the difficulties connected with the work of handling package freight, I think that our efforts have been well spent. (Applause.)

The PRESIDENT—Dr. Pender, on behalf of the Club, I wish to extend to you and to your associates who assisted in preparing the paper, the sincere thanks of the New York Railroad Club, and to the speakers who have taken part in the discussion the thanks of the Club is also extended.

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